

Lean Six Sigma

3M Lean Six Sigma Deployment

Robert Mitchell – 3M Corporate Quality & Lean Six Sigma Operations



Getting Business Results Faster...
Building Value for our Customers

Commercialization
DMAIC, DFSS and Lean
Entitlement Quality
Manufacturing and Supply Chain
New Systems Introduction

Lean Six Sigma



3M Vision and Mission

Vision -

To be the most innovative enterprise and the preferred supplier in the markets we serve.

Mission -

To deliver the full power of its technologies, products, reputation, and service to each key customer.

3M Values

- Act with **uncompromising honesty and integrity** in everything we do.
- Satisfy our **customers** with innovative technology and superior quality, value and service.
- Provide our **investors** an attractive return through sustainable, global growth.
- Respect our social and physical **environment** around the world.
- Value and develop our **employees'** diverse talents, initiative and leadership.
- **Earn the admiration** of all those associated with 3M worldwide.



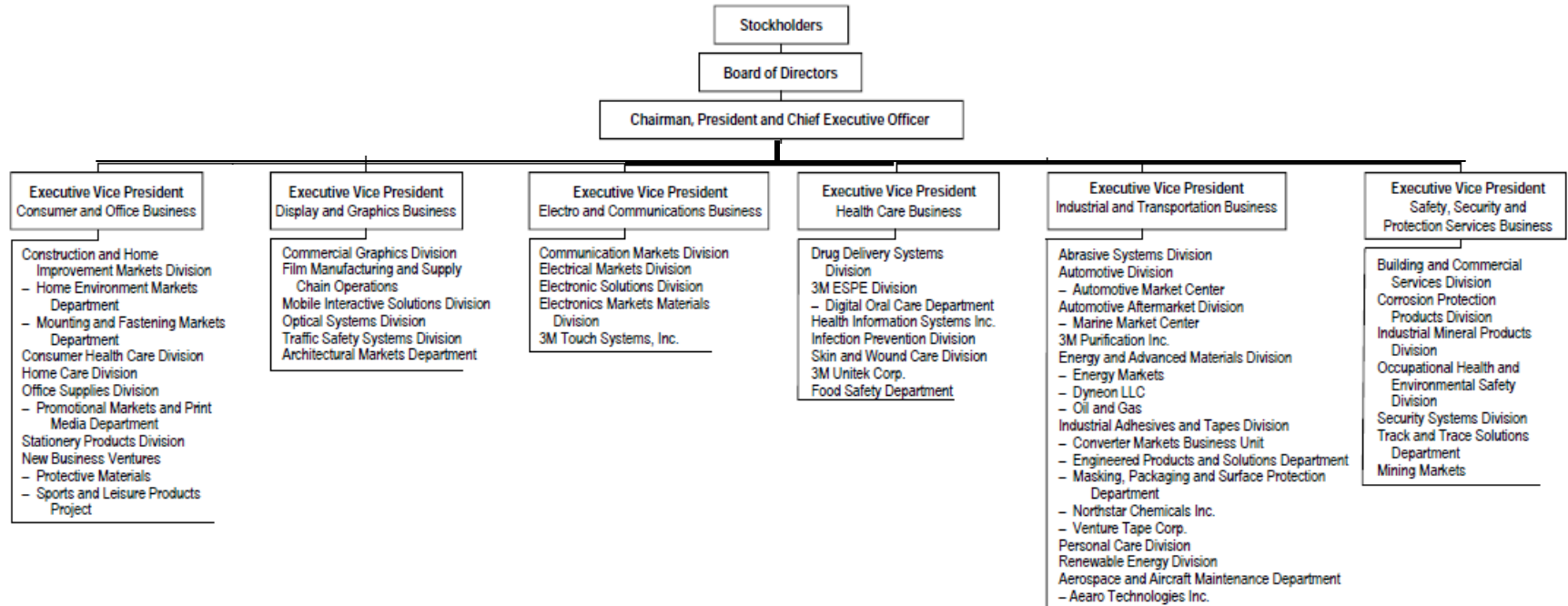
2010 Corporate Overview



Innovating
Toward
Faster Growth



Six Market-Leading Businesses



2010 Recognition

- Fortune's World's Most Admired Companies -- No. 17
- Harris Poll's Most Admired US Company - No. 4
- Bloomberg BusinessWeek's Best Companies for Leadership - No. 3
- Barron's World's Most Respected Companies -- No. 15

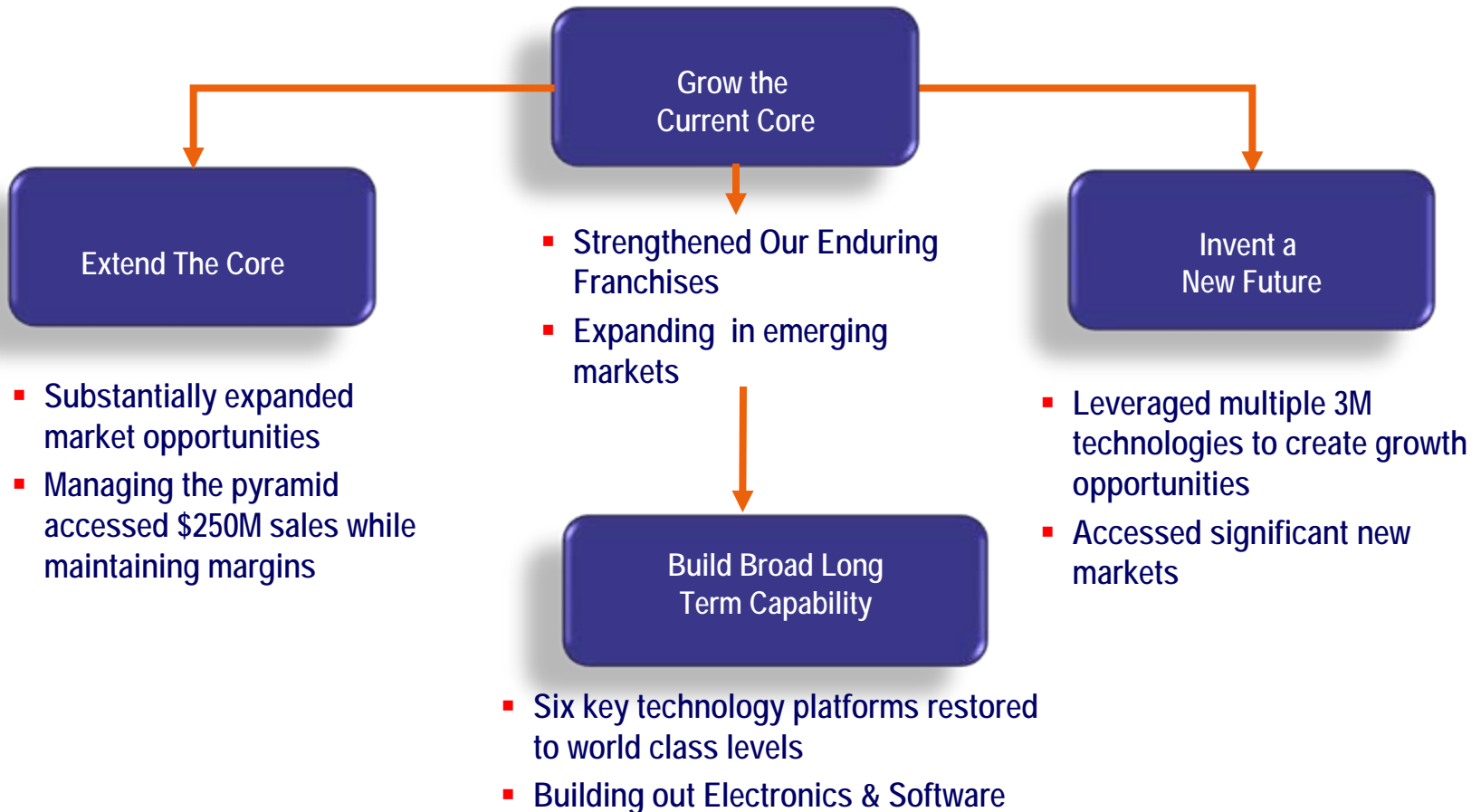


3M's Technology Platforms

<u>Ab</u> Abrasives	<u>Bi</u> Biotech							<u>Pm</u> Polymer Melt Processing	<u>Sm</u> Specialty Materials
<u>Ac</u> Acoustics	<u>Ce</u> Ceramics	<u>Em</u> Electronic Materials					<u>Nt</u> Nano-technology	<u>Po</u> Porous Materials & Membranes	<u>Su</u> Surface Modification
<u>Ad</u> Adhesives	<u>Dd</u> Drug Delivery	<u>Fc</u> Flexible Converting & Packaging				<u>Mi</u> Microbial Detection & Control	<u>Nw</u> Nonwoven Materials	<u>Pp</u> Precision Processing	<u>Tt</u> Track and Trace
<u>Am</u> Advanced Materials	<u>Di</u> Display	<u>Fe</u> Flexible Electronics	<u>Fs</u> Filtration, Separation, Purification	<u>Is</u> Integrated Systems Design	<u>Me</u> Metal Matrix Composites	<u>Mo</u> Molding	<u>Op</u> Opto-electronics	<u>Pr</u> Process Design & Control	<u>Vp</u> Vapor Processing
<u>An</u> Analytical	<u>Do</u> Dental & Orthodontic Materials	<u>Fi</u> Films	<u>Im</u> Imaging	<u>Lm</u> Light Mgmt	<u>Mf</u> Mechanical Fasteners	<u>Mr</u> Micro-replication	<u>Pd</u> Particle & Dispersion Processing	<u>Rp</u> Radiation Processing	<u>We</u> Accelerated Weathering
<u>As</u> Application Software	<u>Ec</u> Energy Components	<u>Fl</u> Fluoro-materials	<u>In</u> Inspection & Measurement	<u>Md</u> Medical Data Mgmt			<u>Pe</u> Predictive Engineering & Modeling	<u>Se</u> Sensors	<u>Wo</u> Wound Mgmt



Refocusing on Faster Growth



Acquisitions and International growth, key growth contributors



Solving Problems Everywhere

- Operate companies in more than 65 countries
 - 35 international companies with manufacturing operations, 35 with laboratories
 - In the United States, operations in 28 states
- R&D and related expenditures total \$6.861 billion for the last five years
- More than 75,000 employees worldwide
- We provide 'borderless customer success'



Baldrige criteria - Item 2.2

Strategy Deployment

2.2 Strategy Deployment: How do you deploy your strategy? (45 pts.)

Process

Describe HOW your organization converts its STRATEGIC OBJECTIVES into ACTION PLANS. Summarize your organization's ACTION PLANS, HOW they are DEPLOYED, and KEY ACTION PLAN PERFORMANCE MEASURES or INDICATORS. Project your organization's future PERFORMANCE relative to KEY comparisons on these PERFORMANCE MEASURES or INDICATORS.

Within your response, include answers to the following questions:

a. ACTION PLAN Development and DEPLOYMENT

- (1) What are your KEY short- and longer-term ACTION PLANS? What are the KEY planned changes, if any, in your products, your CUSTOMERS and markets, and how you will operate?
- (2) How do you develop and DEPLOY ACTION PLANS throughout the organization to your WORKFORCE and to KEY suppliers and PARTNERS, as appropriate, to achieve your KEY STRATEGIC OBJECTIVES? How do you ensure that the KEY outcomes of your ACTION PLANS can be sustained?
- (3) How do you ensure that financial and other resources are available to support the accomplishment of your ACTION PLANS, while meeting current obligations? How do you allocate these resources to support the accomplishment of the plans? How do you assess and manage the financial and other risks associated with the plans?
- (4) How do you establish and DEPLOY modified ACTION PLANS if circumstances require a shift in plans and rapid execution of new plans?
- (5) What are your KEY human resource or WORKFORCE plans to accomplish your short- and longer-term STRATEGIC OBJECTIVES and ACTION PLANS? How do the plans address potential impacts on people in your WORKFORCE and any potential changes to WORKFORCE CAPABILITY and CAPACITY needs?
- (6) What are your KEY PERFORMANCE MEASURES or INDICATORS for tracking the achievement and EFFECTIVENESS of your ACTION PLANS? How do you ensure that your overall ACTION PLAN measurement system reinforces organizational ALIGNMENT? How do you ensure that the measurement system covers all KEY DEPLOYMENT areas and STAKEHOLDERS?



Baldrige criteria - Item 4.1

Measurement, Analysis and Knowledge Mgmt

4.1 Measurement, Analysis, and Improvement of Organizational Performance: How do you measure, analyze, and then improve organizational performance? (45 pts.)

Process

Describe HOW your organization measures, analyzes, reviews, and improves its PERFORMANCE through the use of data and information at all levels and in all parts of your organization.

Within your response, include answers to the following questions:

a. PERFORMANCE Measurement

- (1) How do you select, collect, align, and integrate data and information for tracking daily operations and for tracking overall organizational PERFORMANCE, including progress relative to STRATEGIC OBJECTIVES and ACTION PLANS? What are your KEY organizational PERFORMANCE MEASURES, including KEY short-term and longer-term financial MEASURES? How frequently are these MEASURES determined? How do you use these data and information to support organizational decision making and INNOVATION?
- (2) How do you select and ensure the EFFECTIVE use of KEY comparative data and information to support operational and strategic decision making and INNOVATION?
- (3) How do you keep your PERFORMANCE measurement system current with business needs and directions? How do you ensure that your PERFORMANCE measurement system is sensitive to rapid or unexpected organizational or external changes?

b. PERFORMANCE ANALYSIS and Review

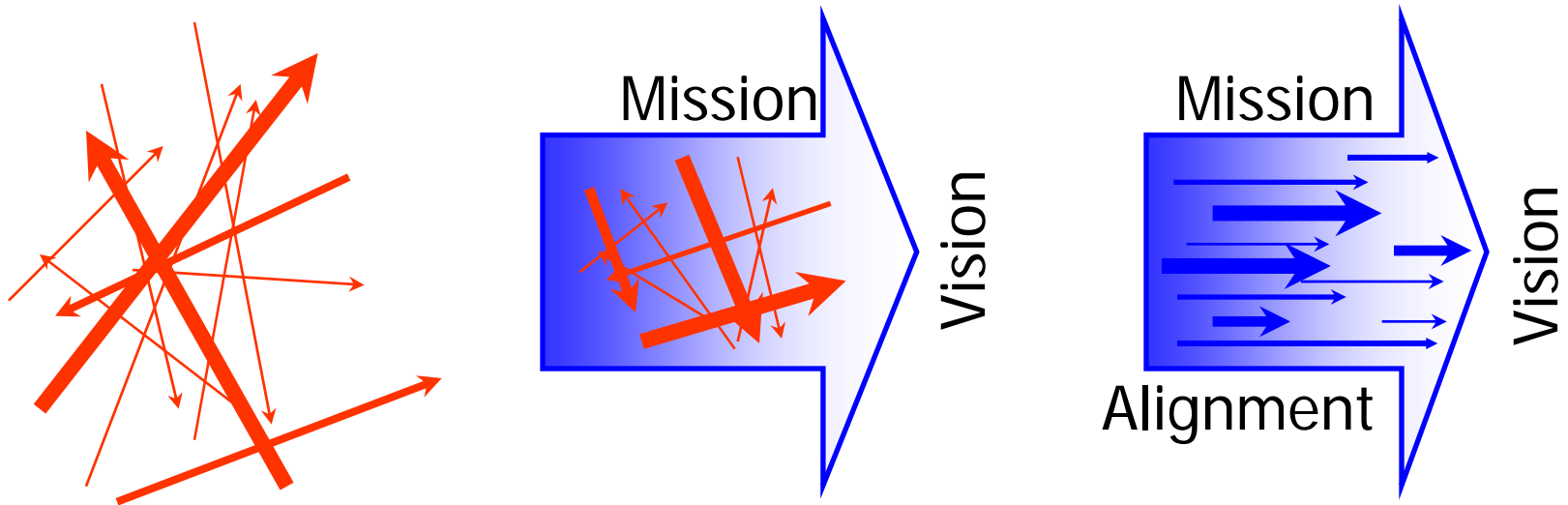
How do you review organizational PERFORMANCE and capabilities? What ANALYSES do you perform to support these reviews and to ensure that conclusions are valid? How do you use these reviews to assess organizational success, competitive PERFORMANCE, and progress relative to STRATEGIC OBJECTIVES and ACTION PLANS? How do you use these reviews to assess your organization's ability to respond rapidly to changing organizational needs and challenges in your operating environment?

c. PERFORMANCE Improvement

How do you translate organizational PERFORMANCE review findings into priorities for continuous and breakthrough improvement and into opportunities for INNOVATION? How are these priorities and opportunities DEPLOYED to work group and functional-level operations throughout your organization to enable EFFECTIVE support for their decision making? When appropriate, HOW are the priorities and opportunities DEPLOYED to your suppliers, PARTNERS, and COLLABORATORS to ensure organizational ALIGNMENT?



Alignment Drives Speed



2010 Corporate Quality / LSS Goal Tree

Winning Strategies

**Accelerate
Healthy
Growth**

**Operational
Excellence**

**Engaged
Employees**

Entitlement Quality - Competitive Advantage

Increase Customer Engagement & Knowledge

Develop a Run to Target Culture

Launch Global CFR Project

NPI Speed & Effectiveness

Link Customer CTQ's to Execution

Utilize CQI scorecard

LSS - Drive Improvement in Stability and Capability

Customer Projects. "At the Customer/For the Customer"

Reduce COPQ

Drive Transactional Lean

Improve Supplier Capability

Drive Continuous Improvement and Sustainability

Leadership Development / Careers in Quality & LSS

Align employee expectations to business results

Embrace Human Sigma Principles

Reward & Recognize

Customer Success

"Putting It All Together"

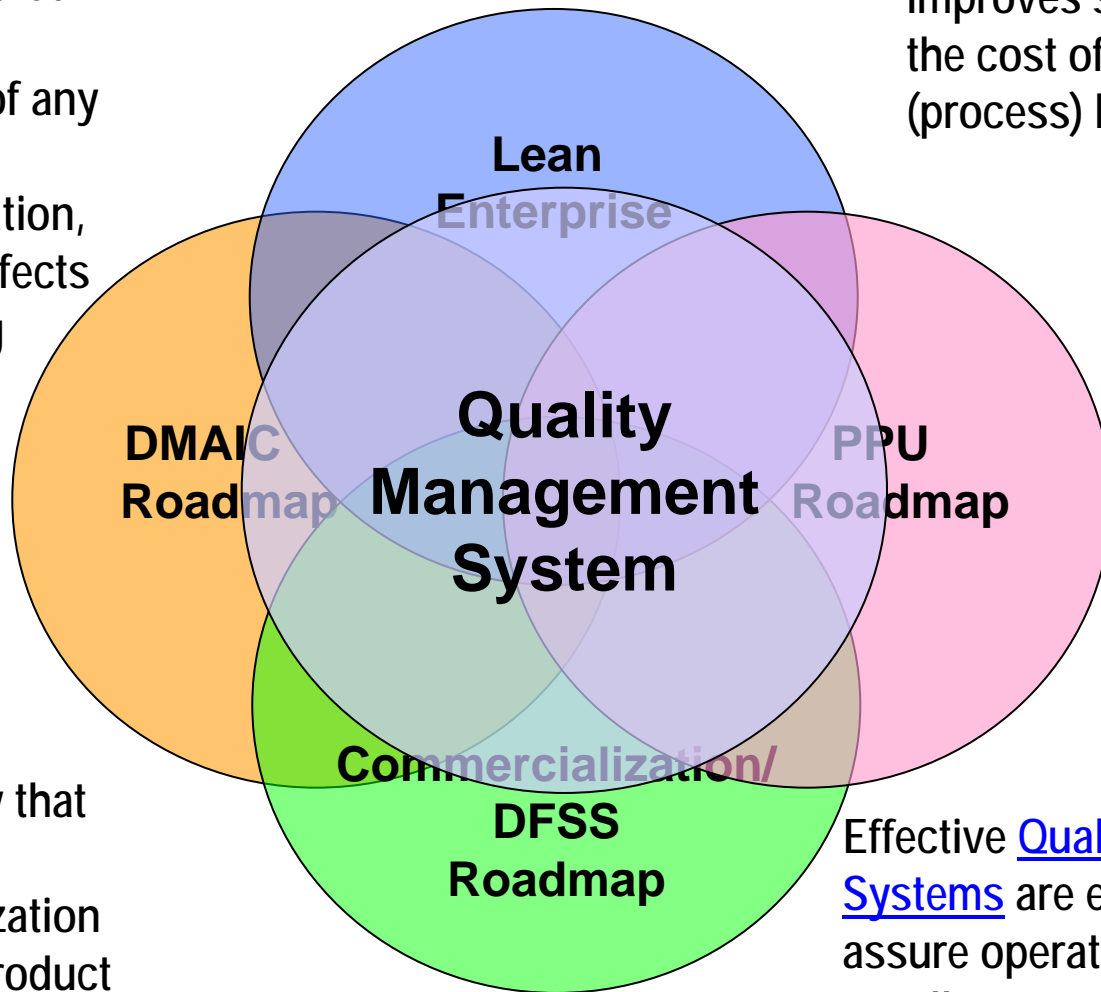
DMAIC is a methodology that improves the performance of any process by reducing variation, decreasing defects and improving quality

Lean is a business management philosophy that improves speed and reduces the cost of any value stream (process) by removing waste

PPU is a 3M-borne methodology that aligns the voice of the process to the voice of the customer and promotes the documentation of that knowledge

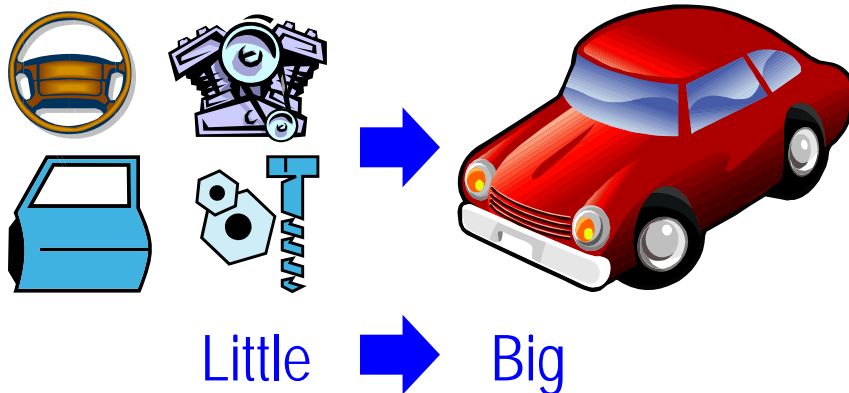
DFSS is a methodology that supports the commercialization process in product development

Effective Quality Mgmt Systems are essential to assure operational excellence, customer satisfaction and employee engagement.



Not Making Cars

Making Cars



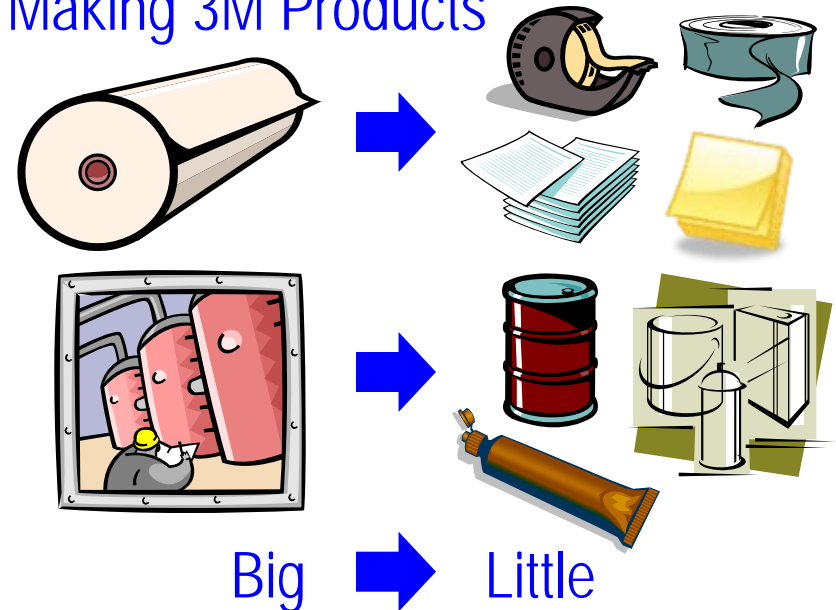
The Big "each" in the Value Stream is...

- At the end of the Value-add
- Same as the final Customer "each"
(Customer sees value in the big "each")

Discrete assembly process

- Uniform "whole eaches" relationships
- Few (any?) large batch size mismatches
- Material to the line is entirely consumed
- Low mix (at Customer SKU level)

Making 3M Products



The Big "each" in the Value Stream is...

- At the front of the Value-add
- Different (much larger) than the final Customer "each"

"Non-discrete dis-assembly process"

- Few "whole eaches" relationships
- Large batch size mismatches
- Multiple consumption cycles of partials
- High mix (at Customer SKU level)

That said, the underlying principles of Lean Six Sigma still apply to both

Underlying Lean Six Sigma Principles Still Apply

- Value is defined in the eyes of the Customer
- Speed through elimination of Waste (remove non-Value-add)
- Continuous Flow → evidenced by Speed
- Clear alignment to Business Goals
- Value Stream Owners that drive improvement
- Results and performance are visible – no problems are hidden
- Built-in quality assurance – fix problems versus passing them along
- Standardization as the basis for continuous improvement
- Learning organization
- Pervasive culture of problem solving and continuous improvement

The above principles apply for Value Stream improvement, regardless of the process, product or type of Value Stream



3M Lean Six Sigma (LSS) and Value Stream Improvement (VSI) Structure

- 3M Lean Six Sigma Operations group
 - *Corporate Staff with assigned support by corporate business units*
 - *Lean Six Sigma (LSS) and Black Belt (BB) coaches / consultants*
 - *3M Value Stream Improvement (VSI) Team*
- 3M Value Stream Improvement (VSI) Intranet Website
 - *"One Stop Shop" for Value Stream Improvement tools & collaboration*
- 3M Corporate Lean Six Sigma training
 - *Classes and workshops*
- Global Coach Network
- Lean Six Sigma resources embedded in 3M business units
 - *Lean Six Sigma Master Black Belts (MBB), Black Belts (BB), Green Belts (GB)*
 - *Division Lean Managers*
 - *Lean SME's (Subject Matter Experts)*
 - *Primarily in manufacturing sites*



The Goal

The Goal: → Creating Value for the Customer, *while...*
→ Achieving 3M business goals

Value-Add: → Direct transformation of materials and/or services into acceptable (sellable) products for the customer;
→ Value is defined in the eyes of the customer – what the customer is willing to pay for

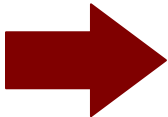
Non Value-Add: → Anything that does not directly accomplish the above;
→ Consumes time, resources and money without adding value (in the customer's eyes)

Lean Six Sigma is not the goal, it is the improvement methodology to achieve the goal



How can we get better faster?

...as measured by business results.

 Business Results
Through Value Stream Improvement

→ *Getting business results*

→ *Through Value Stream improvement*

→ *For getting better faster*

"Getting Business Results Faster"



Lean Building Blocks

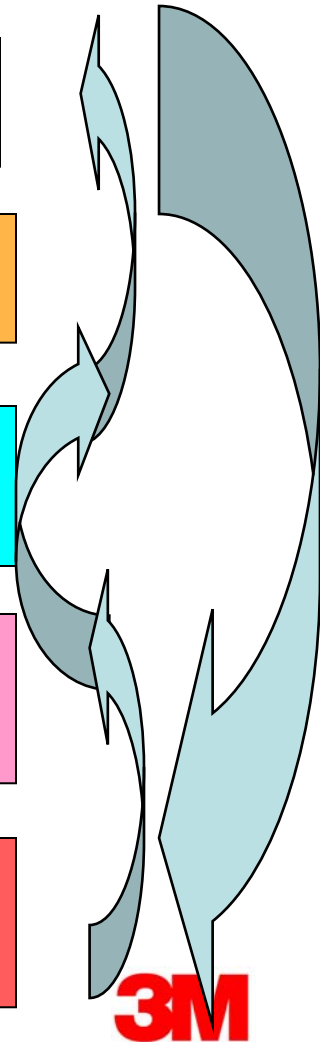
Pull Processes

Develop Flow

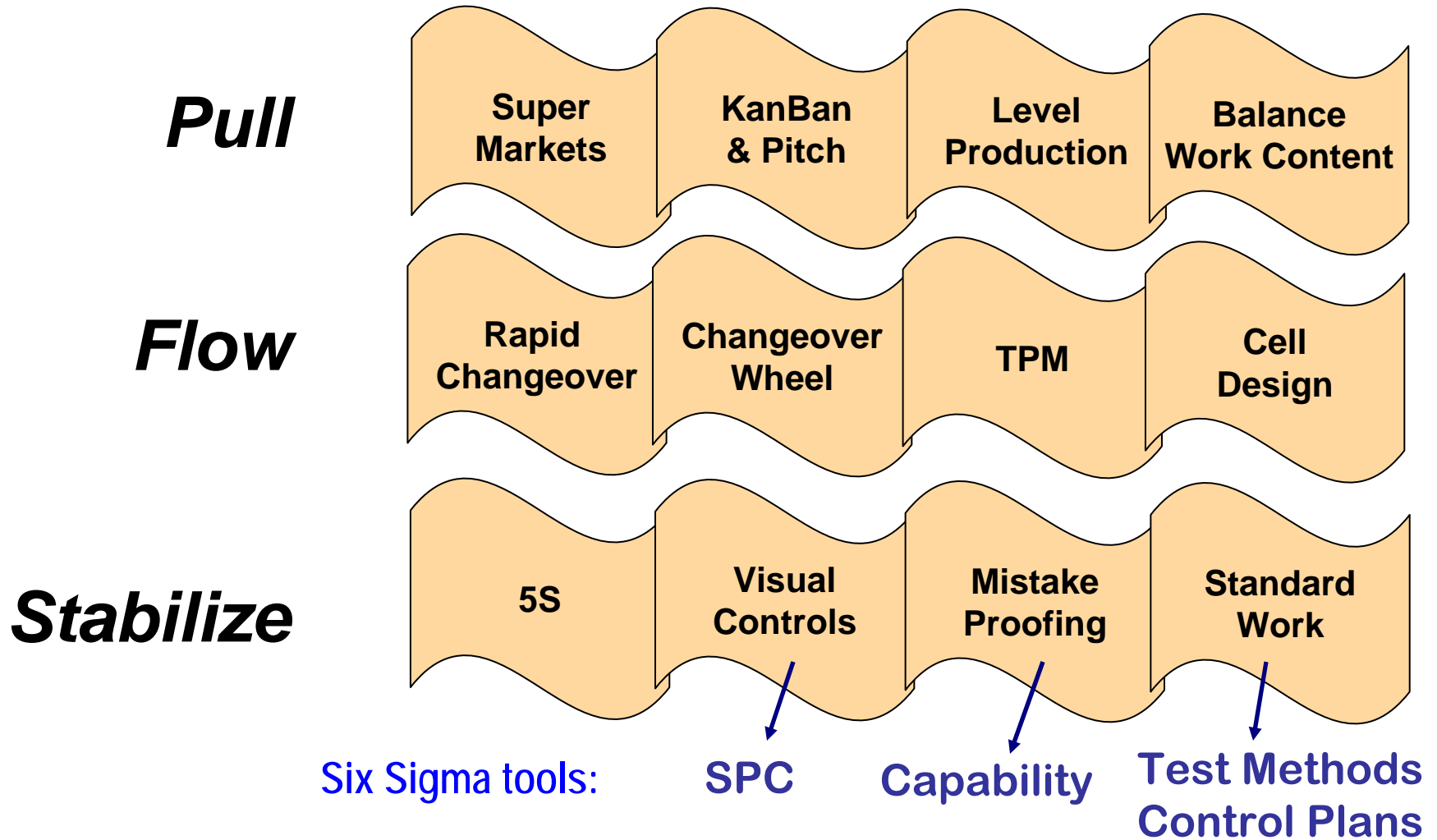
Stabilize Value Stream

Stabilize Individual Processes

Assess Value Stream



Lean Tools

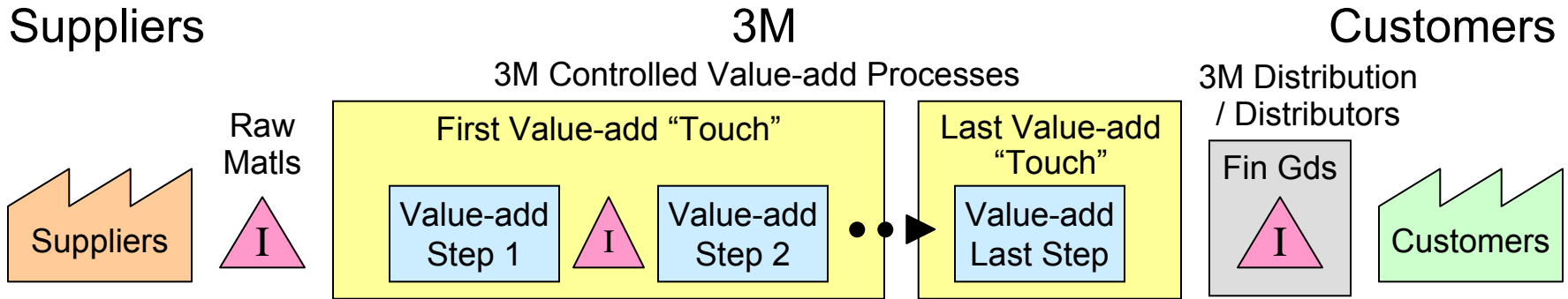


Focus on the Value Stream

Why? – The Value Stream is ultimately what customers pay us for

- Maintain focus on Creating Value, i.e. products / activities in which customers will recognize value (and pay for it)
- The inherent value of every process, task or activity is relative to its positive contribution to the Value Stream
- Waste is opposed to Value

What is a Value Stream?



Value Stream – Basic Definition

- A sequence of value creation process steps to transform materials, information and/or services into acceptable (sellable) products that the customer sees value in (i.e. is willing to pay for)

Extended (Enterprise-wide) Value Stream

- A sequence of value creation process steps that occur across multiple locations for a particular set of products
 - *Supplier(s) to end customer(s)*
 - *Multiple 3M plants / contract manufacturing / distribution*
 - *Site-to-site transportation*



Essential for Value Stream Improvement

- Value Stream **Ownership**
- Value Stream **Performance Visibility**
- Applies to both Local (“Within 4 Walls”) and Extended Value Streams

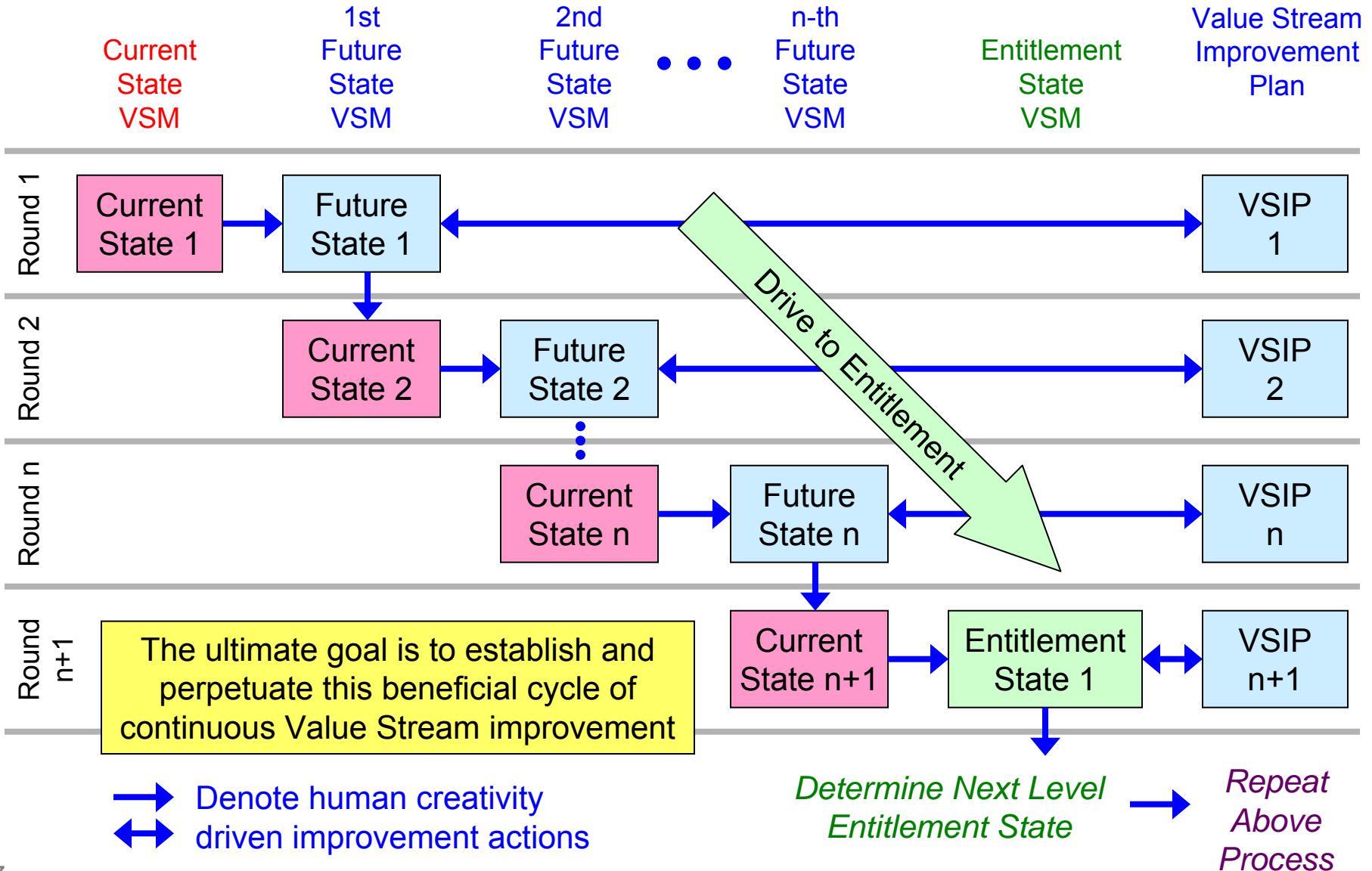
Value Stream Ownership

- Every Value Stream must be owned
 - *Can't improve what isn't owned*
- Value Stream Owner should be a single individual
- Responsibilities of Ownership:
 - *Alignment of Value Stream performance to Business Goals*
 - *Driving end-to-end Value Stream improvement*
 - *Synchronization across the Extended Value Stream*

Value Stream Performance Visibility

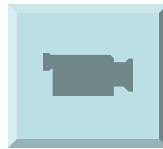
- No problems should be hidden
 - *Can't improve what you can't see*
- Make performance results visible – with data
- Value Stream Map
 - *A visual representation of the Value Stream*
- Value Stream alignment to Business Goals
- Value Stream Metrics
- Value Stream Improvement Plan

Value Stream Improvement Action Cycle



Mercury Marine "QUEST" - Lean example

- <http://www.youtube.com/watch?v=qLYSy0REqDA>



Value Stream Improvement Action Sequence

1. **Document the Current State** (how things are now)
2. **Envision the Entitlement State** (what it could / should be)
3. **Generate improvement ideas & goals** (human creativity driven)
 - a. *Brainstorming*
 - b. *Try-storming*
 - c. *Replicating best practices of others*
 - d. *Business objectives and customer / marketplace forces*
4. **Determine an improved Future State** (incorporating a sizable step towards Entitlement)
5. **Implement the improved Future State**

Utilizing a Value Stream Improvement Plan consisting of:

 - a. *Action items*
 - b. *JDI (just-do-it) projects*
 - c. *Small projects*
 - d. *Large projects*
 - e. *Control / sustainability plan*
6. **Achieve sustained performance of the Future State**
7. **Once sustained, Future State now becomes Current State**
8. **Repeat steps 2 through 7, over and over again**
9. **Drive to Entitlement**

Leadership – the Critical X

Leadership, Culture and Sustainability

- Leaders are the primary drivers of deep and lasting culture change in organizations
- Leaders most strongly influence and guide approach to issues, continuous improvement methodologies and day-to-day behavior
- Leaders must be actively and visibly engaged in driving implementation in the organization
- Leaders are the key factor (the Critical X) in establishing a lasting sustainable Lean Six Sigma Culture in the organization

Seeing the Flow

"The Gold is in the flow."

"I can see your inventory, but where is your factory?"

from The Gold Mine
by Freddy & Michael Ballé

Seeing the Flow

- Look for and achieve Continuous Flow
- Speed metrics provide evidence of improving Flow
- View Value Stream issues and improvement actions relative to impact on Flow and Speed

See the Flow → Work on Speed



Benefits of Speed – with Stability & Capability

- Speed of the Value Stream

- *Overall Speed (Time) of the Value Stream*
 - *How long does it take in real calendar time to:*
 - *Transform RM's into products the customer will pay for (Value-add)*
 - *Move material through the Value Stream (Flow)*

- How to improve Speed

- *Speed through elimination of Waste (remove non-Value-add)*
 - *Product quality capability and predictability*
 - *Improve Runtime, Rate and Yield*
 - *Stability and predictability of operations*

- Benefits of Speed

– Can improve all three at the same time:

- *Responsiveness to the Customer [Growth]*
- *Inventory (Cash)*
- *Cost*

Speed provides competitive advantage for the Value Stream



Going Faster

Actions to improve Value Stream Speed

- Make sure the Value Stream is owned – both Extended & Local levels
- Start measuring and tracking Speed of the Value Stream
 - *Value Creation Time, Total Days of Inventory, Total Cycle Time Days*
- Develop a Value Stream Improvement Plan (VSIP / EVSIP)
- Simplify the Value Stream – reduce “Touches” and distance
- Reduce batch / lot sizes; shorten run lengths (~~big batch mentality~~)
- Improve throughput at the Constraint (i.e. Runtime, Rate & Yield)
- Move the Constraint / Pacemaker upstream (Push-Flow boundary)
- Reduce the number of scheduling points (single point scheduling)
- Challenge every Inventory location
 - *Question the need – seek to eliminate*



Call Timeout

Anti-Lean Six Sigma Moves:

- The line was running well, so we went ahead and made a little extra [Overproduction is a LSS Waste]
- Inventory is viewed as positive thing to have more of [Inventory is a LSS Waste]
- Our changeovers are really long, so we need to increase our run lengths
- We should make the biggest Batch or Jumbo possible to be more efficient
- Process is out of control, but kept running because “still in spec”



Actions of this nature move away from Speed and Continuous Flow

When Getting Started

- Focus on scope, impact and culture – not on tools
- Apply tools as necessary to solve a real business problem
 - *It's not about the tools, it's about improvement*
 - *Lead with the business problem, then bring the appropriate tools in as needed*
- Don't do everything at once
 - Focus on a key Value Stream
- Use a matrixed, broad spectrum approach
 - *Don't use tools in isolation and serially – limits synergy, too slow*
 - *Use LSS tools in an integrated, matrixed, parallel-path fashion*
- Some quick hits* to build momentum and “buzz” are OK, but also start attacking the “biggies” for long-term sustainability
- Constant throughout everything
 - *Respect for people – they make everything happen*
 - *Continual elimination of waste (things contrary to adding value)*

Checking question: “Does this add value that the customer will notice (and pay for)?”

* In future, quick hits should be augmented with a “What can we improve today?” approach to daily root cause problem solving in the organization



Thank You